

REMARKS

Claims 1 and 2 are amended. The amendments are supported by the application as originally filed, for example, figures 4-15 and the description thereof. No new matter is added by the amendments.

Claims 1 and 2 are rejected under 35 U.S.C. §102(b) as being anticipated by Dolan et al. (US 5,859,510). Applicants traverse the amendment to the extent that it can be maintained.

Claims 1 and 2 now recite first and second motors each generating a steering assisting force. First and second drive circuits provide PWM-control of the first and second motors, respectively, and each include a switching element adapted to be switched on and off at a control frequency. A controller differentiates the control frequency at which the switching element of the first drive circuit is switched on and off, and the control frequency at which the switching element of the second drive circuit is switched on and off. As explained in the BACKGROUND OF THE INVENTION, the dual motor-type steering apparatus has a problem that switching noise and magnetostrictive sound are produced from respective drive circuits of the two motors. According to the present invention, a control frequency or a shape of a pulse signal concerning one motor and a control frequency or a shape of a pulse signal concerning the other motor are made different from one another thereby preventing switching from occurring at the same time. The effect is to reduce the peaks of the switching noise levels by virtue of level distribution attained by the differentiated switching timing of the switching elements.

Dolan et al. disclose a circuit driver for a single brushless motor. The object of the Dolan et al. invention is to provide a low cost board for commutating the brushless motor. Effectively Dolan et al. relates to a control method for a single brushless motor wherein a frequency difference or a phase difference occurs between an upstream side and a downstream side of an H-bridge circuit. Dolan et al. do not disclose a structure including two motors whereby a control frequency or a shape of a pulse signal concerning one motor and a control frequency or a shape of a pulse signal concerning the other motor are made different from one another thereby preventing switching from occurring at the same time. Applicants' respectfully submit that Dolan et al. do not anticipate amended claims 1 and 2, and request that the rejection be withdrawn.

Claims 1 and 2 are rejected under 35 U.S.C. §102(b) as being anticipated by Beck (US 6,008,599). Applicants traverse the amendment to the extent that it can be maintained.

Beck discloses an apparatus for controlling an electric motor in a driving system using different frequencies or different phases in PWM control to provide improved current sensing ability and other advantages (column 2 lines 12-17). Beck is not concerned with reducing switching noise levels experienced with a dual motor steering apparatus. Beck discloses a control means for PWM for first and second switches connected to first and second terminals respectively of a single motor. Beck does not disclose a structure involving two motors and two drive circuits to control the on-off states of the switching elements of the separate drive circuits. Applicants respectfully submit that Beck does not anticipate amended claims 1 and 2, and request that the rejection be withdrawn.

In view of the above amendments and remarks, Applicants respectfully request a Notice of Allowance. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at the below-listed telephone number.

Respectfully submitted,

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By

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